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TRIQUINT SEMICONDUCTOR, INC.

TQS

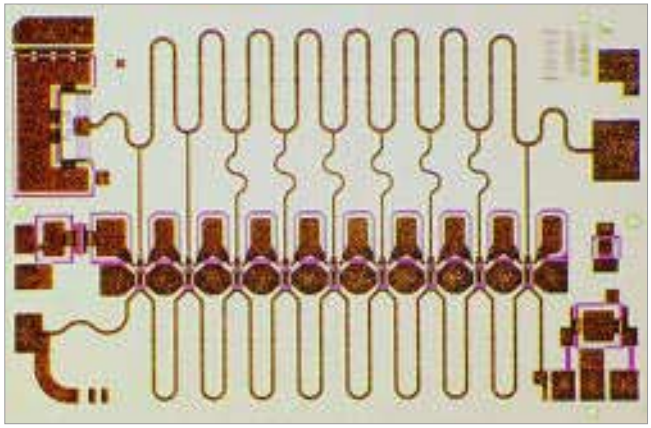
TGA8349-SCC

Gain Block Amplifier

8349

- **DC to 14-GHz Frequency Range**
- **1.2:1 Input SWR, 1.3:1 Output SWR**
- **11-dB Small Signal Gain**
- **16-dBm Output Power at 1-dB Gain Compression at Midband**
- **3.1-dB Noise Figure at Midband**
- **3,4290 x 2,2860 x 0,101 mm (0.135 x 0.090 x 0.004 in.)**

PHOTO ENLARGEMENT

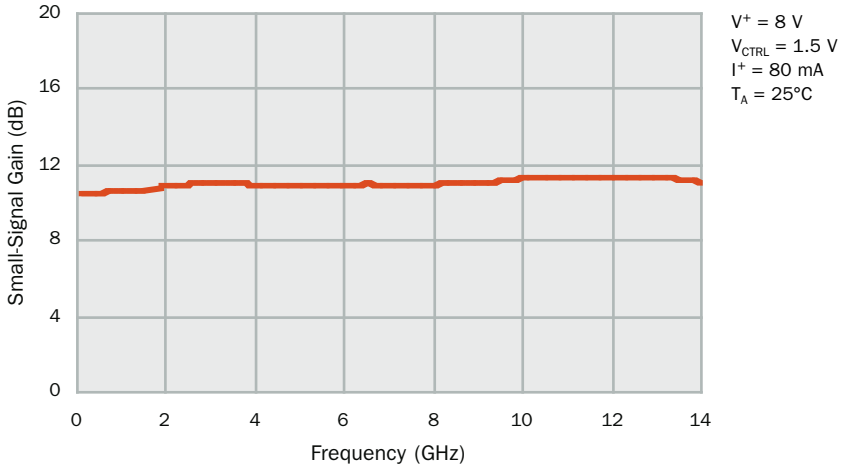


DESCRIPTION

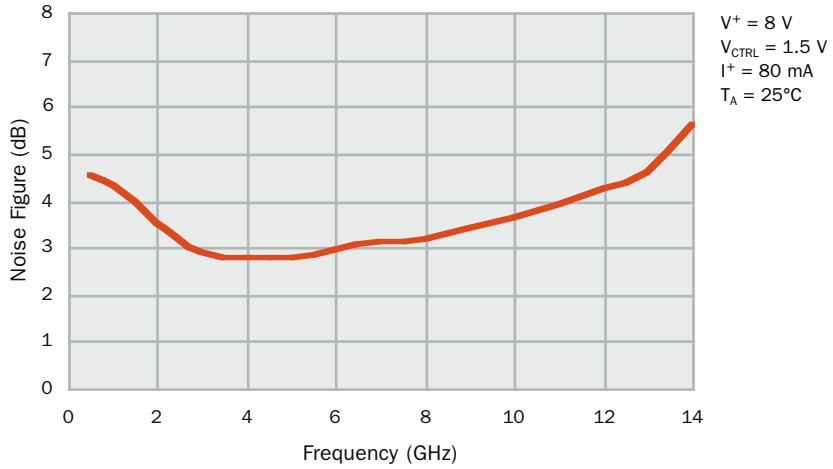
The TriQuint TGA8349-SCC is a GaAs monolithic low-noise distributed amplifier designed for use as a multi-octave general-purpose gain block. Nine 122-µm gate width FETs provide 11-dB nominal gain and 3.1-dB noise figure from DC to 14-GHz. Typical power output is 16-dBm at 1-dB gain compression. Typical input SWR is 1.2:1 and output SWR is 1.3:1. Ground is provided to the circuitry through vias to the backside metallization.The DC to 14 -GHz frequency range, dual-gate AGC control and gain-flatness characteristics make the TGA8349 -SCC suitable for many system applications including fiber optic.

The TGA8349-SCC is supplied in chip form and is engineered for high-volume automated assembly. All metal surfaces are gold plated to be compatible with thermocompression and thermosonic wire-bonding processes.

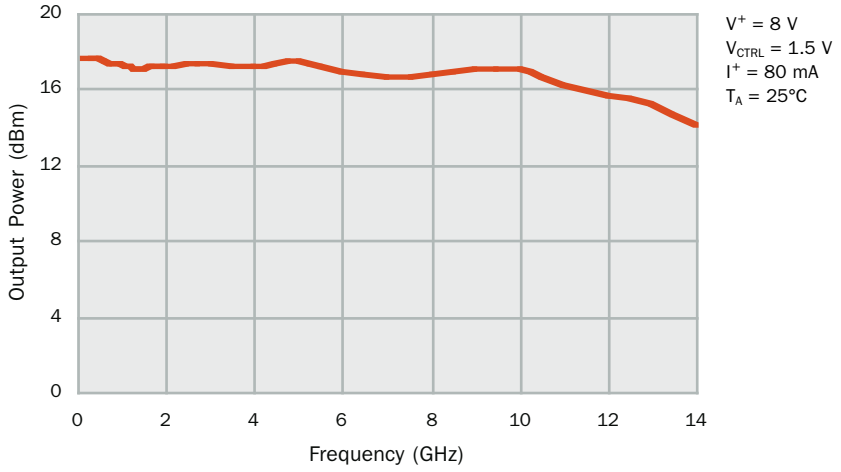
TYPICAL SMALL SIGNAL POWER GAIN



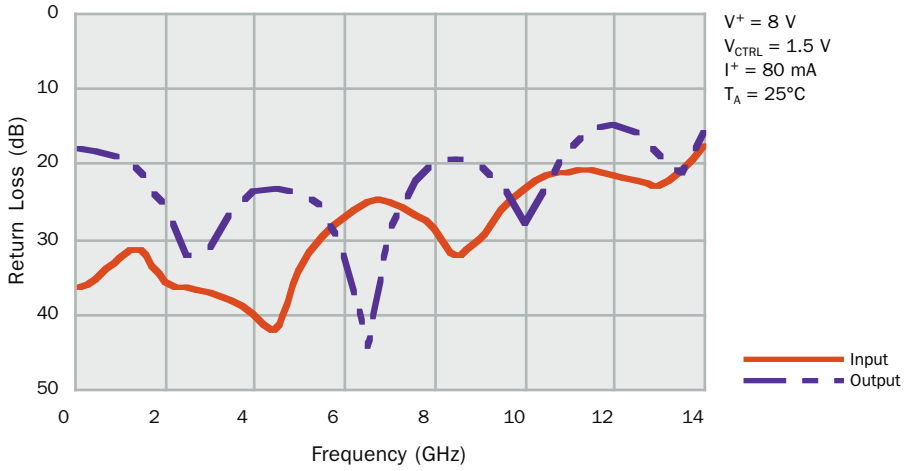
TYPICAL NOISE FIGURE



TYPICAL OUTPUT POWER
P_{1dB}



TYPICAL RETURN LOSS



ABSOLUTE MAXIMUM RATINGS

Positive supply voltage, V^+	13 V
Positive supply voltage range with respect to negative supply voltage, $V^+ - V^-$	0 V to 13 V
Positive supply voltage range with respect to gain control voltage, $V_{CTRL} - V^+$	0 V to -13 V
Negative supply voltage range, V_{G1}	-5 V to 0 V
Gain control voltage range, V_{CTRL}	-5 V to 4 V
Positive supply current, I^+	144 mA
Power dissipation, P_D, at (or below) 25°C base-plate temperature*	2.6 W
Input continuous wave power, P_{IN}	23 dBm
Operating channel temperature, T_{CH}**	150°C
Mounting temperature (30 sec), T_M	320°C
Storage temperature range, T_{STG}	-65 to 150°C

Ratings over channel temperature range, T_{CH} (unless otherwise noted)

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "RF Characteristics" is not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

* For operation above 25°C base-plate temperature, derate linearly at the rate of 5.5 mW/5C.

** Operating channel temperature directly affects the device MTTF. For maximum life, it is recommended that channel temperature be maintained at the lowest possible level.

TYPICAL S-PARAMETERS

Frequency	S_{11}		S_{21}		S_{12}		S_{22}		GAIN
(GHz)	MAG	ANG(°)	MAG	ANG(°)	MAG	ANG(°)	MAG	ANG(°)	(dB)
0.1	0.02	115	3.32	173	0.001	85	0.12	180	10.4
0.5	0.02	92	3.34	155	0.003	73	0.12	161	10.5
1.0	0.02	26	3.36	130	0.005	53	0.11	142	10.5
1.5	0.03	-28	3.40	106	0.008	31	0.09	112	10.6
2.0	0.02	-72	3.46	80	0.011	6	0.05	80	10.8
2.5	0.02	-122	3.51	54	0.013	-20	0.02	21	10.9
3.0	0.01	-165	3.52	28	0.015	-46	0.03	-73	10.9
3.5	0.01	139	3.53	2	0.017	-71	0.05	-118	10.9
4.0	0.01	87	3.51	-24	0.019	-97	0.07	-151	10.9
4.5	0.01	12	3.48	-50	0.021	-121	0.07	-180	10.8
5.0	0.02	-74	3.48	-76	0.024	-146	0.06	155	10.8
5.5	0.03	-112	3.48	-101	0.026	-170	0.05	132	10.8
6.0	0.04	-142	3.49	-127	0.029	166	0.03	106	10.9
6.5	0.06	-167	3.52	-154	0.032	144	0.01	-123	10.9
7.0	0.05	167	3.51	180	0.035	120	0.04	-120	10.9
7.5	0.05	150	3.51	154	0.037	95	0.07	-139	10.9
8.0	0.04	141	3.51	127	0.039	71	0.10	-158	10.9
8.5	0.02	163	3.52	100	0.041	46	0.11	-177	10.9
9.0	0.03	-166	3.54	73	0.043	21	0.10	165	11.0
9.5	0.05	-162	3.58	46	0.045	-6	0.07	155	11.1
10.0	0.07	-167	3.63	18	0.047	-34	0.04	179	11.2
10.5	0.08	177	3.63	-11	0.049	-60	0.07	-142	11.2
11.0	0.09	167	3.68	-39	0.054	-89	0.12	-142	11.3
11.5	0.09	156	3.68	-69	0.057	-117	0.17	-160	11.3
12.0	0.08	149	3.68	-99	0.061	-144	0.18	-179	11.3
12.5	0.08	148	3.67	-129	0.066	-172	0.16	163	11.3
13.0	0.07	160	3.65	-160	0.069	160	0.11	156	11.3
13.5	0.09	174	3.63	168	0.072	131	0.09	-172	11.2
14.0	0.13	168	3.57	135	0.072	100	0.16	-156	11.0
14.5	0.16	151	3.46	101	0.072	68	0.23	-171	10.8
15.0	0.15	131	3.36	67	0.070	35	0.25	171	10.5
15.5	0.10	126	3.31	30	0.071	0	0.19	161	10.4
16.0	0.10	160	3.13	-10	0.069	-40	0.16	-171	9.9

V^+ = 8 V, V_{CTRL} = 1.5 V, I^+ = 80 mA, T_A = 25°C

Reference planes for S-parameter data include bond wires as specified in the "Recommended Assembly Diagram."

RF CHARACTERISTICS

	PARAMETER	TEST CONDITIONS	TYP	UNIT
G_P	Small–signal power gain	f = DC to 14 GHz	11	dB
SWR(in)	Input standing wave ratio	f = DC to 14 GHz	1.2:1	-
SWR(out)	Output standing wave ratio	f = DC to 14 GHz	1.3:1	-
P_{1dB}	Output power at 1–dB gain compression	f = 7 GHz	16	dBm
NF	Noise figure	f = 7 GHz	3.1	dB
	Output third harmonic at Pin = -2 dBm	f_o = 1 GHz	-51	dBc*
		f_o = 3 GHz	-47	
		f_o = 5 GHz	-48	
	Output second harmonic at Pin = -2 dBm	f_o = 1 GHz	-26	dBc*
		f_o = 3 GHz	-27	
		f_o = 5 GHz	-28	

V^+ = 8 V, V_{CTRL} = 1.5 V, I^+ = 80 mA T_A = 25°C (unless otherwise noted)

* Unit dBc applies to decibels with respect to the carrier or fundamental frequency, f_o

DC CHARACTERISTICS

PARAMETER	TEST CONDITIONS	MIN	MAX	UNIT
I_{DSS} Total zero–gate–voltage drain current at saturation	V_{DS} = 0.5 V to 3.5 V, V_{GS} = 0 V	131	395	mA

T_A = 25°C

V_{DS} for I_{DSS} is the drain voltage between 0.5 V and 3.5 V at which drain current is highest at DC autoprobe.

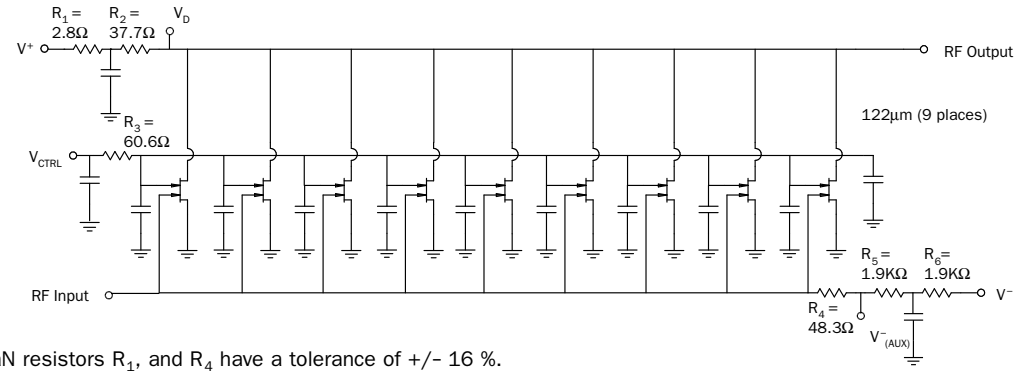
THERMAL DATA

PARAMETER		TEST CONDITIONS	FET	MMIC	UNIT
R_{jC} Thermal resistance, channel–to–backside	V+ = 8 V, Base = 70°C	$V_{DS(FET)}$ = 6.18 V, $I_{D(FET)}$ = 5 mA, channel = 79.6° C	311.4	34.6	°C/W
		$V_{DS(FET)}$ = 5.08 V, $I_{D(FET)}$ = 8 mA, channel = 82.8° C	314.0	35.0	
		$V_{DS(FET)}$ = 4.36 V, $I_{D(FET)}$ =10 mA, channel = 83.8° C	315.7	35.2	

PARAMETER	TEST CONDITIONS	$R_{(RES)}$	UNIT
$R_{(RES)}$ Thermal resistance of drain termination resistor, 37.7	V_{RES} =1.70 V, $I_{D(MMIC)}$ =45 mA, Base =70° C, R_{jC} = 89.5°C/W	76.8	°C/W
	V_{RES} =2.71 V, $I_{D(MMIC)}$ =72 mA, Base =70° C, R_{jC} = 89.7°C/W	87.5	
	V_{RES} =3.39 V, $I_{D(MMIC)}$ =90 mA, Base =70° C, R_{jC} = 90.2°C/W	97.5	

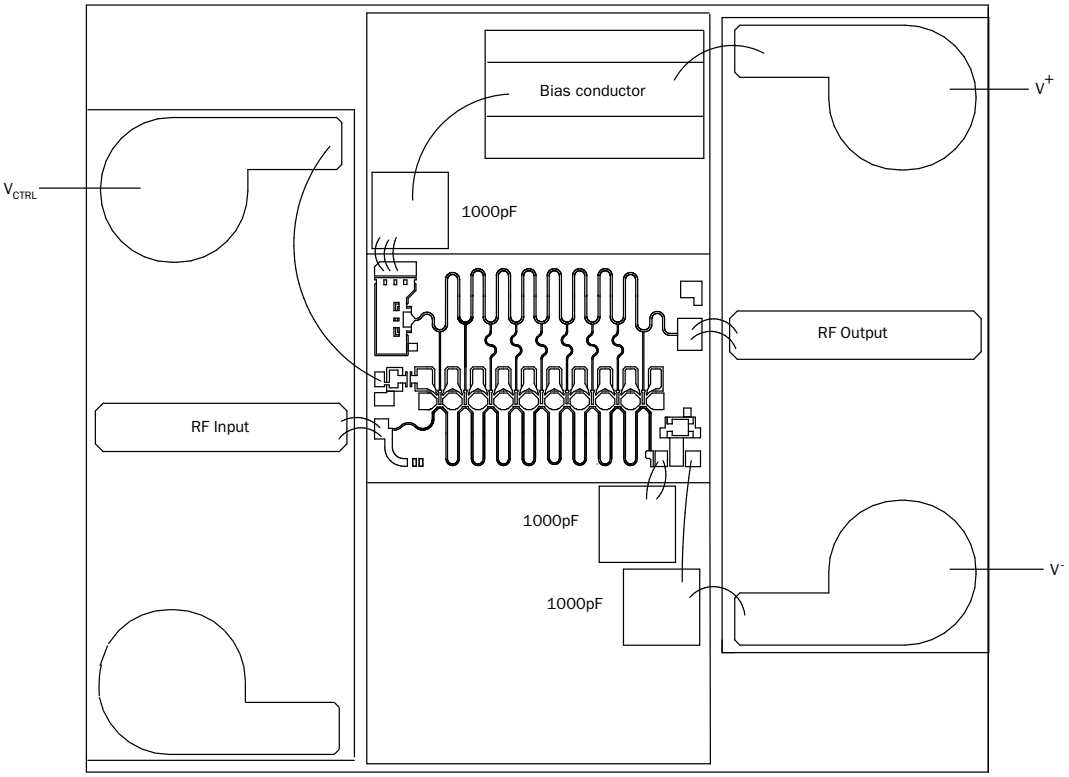
MMIC mounted with 38 m AuSn solder to carrier.
$I_{D(MMIC)}$ = 9 x $I_{D(FET)}$.

EQUIVALENT SCHEMATIC



TaN resistors R_1, and R_4 have a tolerance of +/- 16 %.
GaAs resistors R_2, R_3, R_5, and R_6 have a tolerance of +/- 30 %.

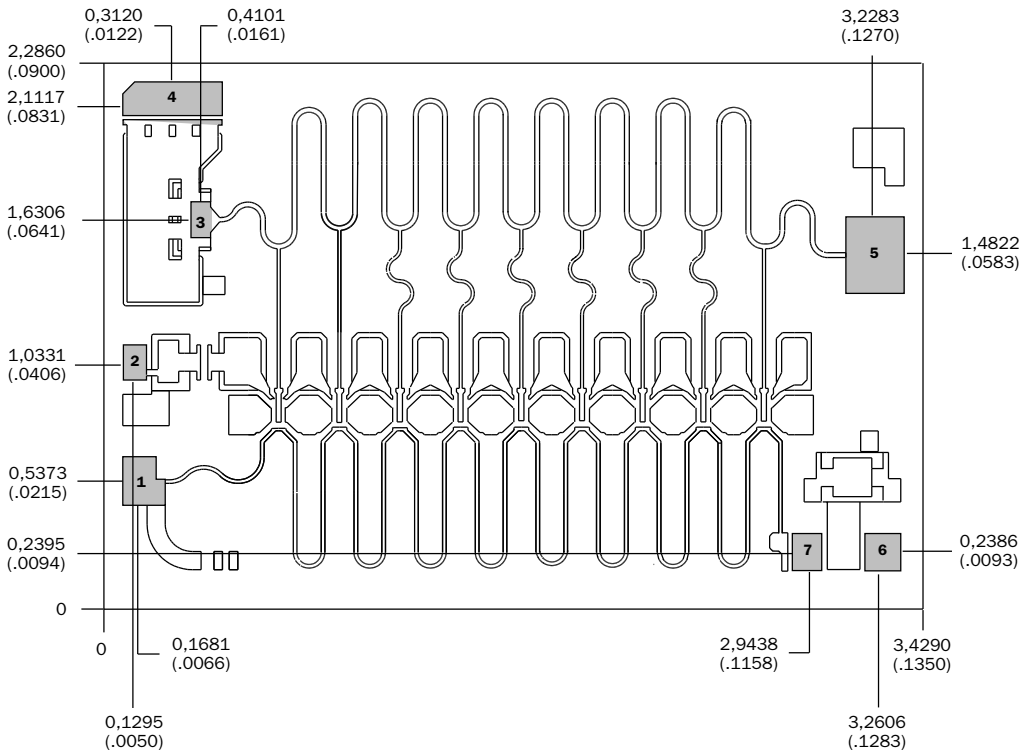
RECOMMENDED ASSEMBLY DIAGRAM



RF connections: Thermocompression bond using two 1-mil diameter, 20 to 30-mil-length gold bond wires at RF Input and at RF Output for optimum RF performance.

Close placement of this capacitor is critical for performance.

MECHANICAL DRAWING



Units: Millimeters (inches)
Thickness: 0,1016 (0.004) (reference only)
Chip edge to bond pad dimensions are shown to center of bond pad
Chip size tolerance: ± 0,0508 (0.002)

Bond pad #1 (RF Input):	0,152 x 0,203 (0.006 x 0.008)
Bond pad #2 (V_{CTRL}):	0,102 x 0,152 (0.004 x 0.006)
Bond pad #3 (V_D):	0,076 x 0,152 (0.003 x 0.006)
Bond pad #4 (V^+):	0,419 x 0,152 (0.016 x 0.006)
Bond pad #5 (RF Output):	0,254 x 0,330 (0.010 x 0.013)
Bond pad #6 (V^-):	0,152 x 0,152 (0.006 x 0.006)
Bond pad #7 ($V^-_{(AUX)}$):	0,127 x 0,152 (0.005 x 0.006)